

A new management framework for western Mediterranean demersal fisheries

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ABSTRACT

The Common Fisheries Policy in the Mediterranean has been so far based on technical measures that have been relatively stable for a long time, and it did not prevent the efficiency increase in both vessels and gears that have counterbalanced the fleet reduction. The new Multiannual Plan for Demersal fish stocks in the western Mediterranean Sea introduces a fishing effort regime as a new approach to reduce significantly fishing time, allowing stocks to approach MSY in the medium term. However, different approaches to reduce fishing time may have different socio-economic impacts that have to be considered. The reduction of fishing time has to be complemented with selectivity improvements, temporal and permanent closures and local co-management plans to protect both juveniles and spawners. The combination of several measures will soften the need for effort reduction and it will contribute significantly to the sustainability of Mediterranean Fisheries.

1. Mediterranean fisheries

The Mediterranean and Black Sea comprise the largest (over 3.4 million km²) and deepest (average 1460 m and maximum 5267 m) enclosed marine basin on Earth. Additionally, the Mediterranean Sea is a hotspot of biodiversity. It hosts approximately 7–10% of the world's marine biodiversity and it holds a high percentage of endemic species [1,2]. The Mediterranean is generally considered a low productive sea, with narrow continental shelves that limit the fisheries productivity across the region. Mediterranean fisheries are characterised by relatively small vessels, multiple landing sites, multispecies catches with low CPUE and relatively high prices [3]. The sector is dominated by small family companies, not only in the small scale fleet segment but also in the trawling and purse seine segments. Despite the depletion of fishery resources, conflicts between countries are rare and limited to few areas. This is because most of the resources (except for large pelagic species managed by ICCAT) are sedentary and therefore their exploitation produces few externalities. The Mediterranean and Black sea fishing fleets transformed more than half its total revenue into capital, salaries, and profits, thereby having a positive impact on the regional economies and their fishing communities [4]. Moreover, Mediterranean fisheries

have a long history that has influenced the culture of coastal communities and has a marked influence in their identity.

2. Common fisheries policy in the Mediterranean

The Common Fisheries Policy in the Mediterranean has been characterised by a suite of technical measures that have been maintained relatively stable for a long time. Meanwhile, fishing mortality has increased over the last decades due to the notable improvement of engines, fishing gears and other technological devices that have resulted in a larger catchability. When fleet profits have decreased in the past, fishing mortality has been adjusted with a fleet reduction. As an example, the Spanish Mediterranean fleet has been reduced from 3337 boats in 2008–2468 in 2017, a 27% decline across all fleet segments: trawlers, purse seiners and small scale boats (Fig. 1). In comparison, the whole Spanish fleet has been reduced by 20% during the same period which indicates a higher reduction in the Mediterranean than in the Atlantic. A lower reduction has been observed in France (12%) or Italy (10%) in the same period. However, according to the results presented by the different stock assessment Working Groups, this fleet reduction has not been enough to allow the recovery of targeted populations

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[5–7]. On the other hand, current economic indicators for the Spanish Mediterranean fleet and the trends of assessed stocks are mainly positive [8].

This situation suggests that management of Mediterranean fisheries has to change to adjust fishing mortality to stock status. In most European fisheries, fishing possibilities are linked to stock status with output limits through total allowable catches (TACs). Output limits are flexible and may adapt fishing mortalities to stock status but they may be ineffective due to several reasons, among them insufficient enforcement or to discarding of marketable fish in mixed fisheries [9]. If fishers have completed their quota of a given species but continue fishing for other species, they will discard or land illegally catches of the species for which the quota is completed [10]. The Landing Obligation seeks to stop this practice but it introduces additional problems, namely the so called choke species, species with a low quota that can cause a vessel to stop fishing even if they still have quota for other species [11], and new enforcement challenges. The issues associated to implementation of TACs and quotas become more difficult to sort with increasingly diverse fisheries, and this is the main reason why TAC and quota have never been considered useful for the highly diverse Mediterranean demersal fisheries. Moreover, the Landing Obligation in the Mediterranean will only be applied to species subjected to Minimum Conservation Reference Size (MCRS) restrictions (species listed in Annex III of Regulation EC1967/2006). In addition, it will not contribute to reach MSY in Mediterranean fisheries since it will not reduce fishing mortality, but it will increase the impact on the ecosystem and will create new problems of management and control [12–14]. Therefore, to reduce discards and mortality of both target and non-target species in the Mediterranean it would be better to replace the Landing Obligation with discard plans including an improvement of selectivity and spatial-temporal closures [9,15,16].

The new multi-annual plan for demersal fisheries in the western Mediterranean (Regulation (EU) 2019/1022 of the European Parliament and of the Council of June 20, 2019, OJEU L172/1) introduces the concept of maximum allowable fishing effort. It is based in fixing a maximum number of fishing days per year as a way to adjust fishing mortality to stock status. A significant reduction of fishing time should be applied in the next years to approach fishing mortality to F_{MSY} . However, the proposal does not regulate how to distribute the fishing days throughout the year and across the fleet. The socio-economic impact of reducing fishing mortality will differ among the possible strategies. It must also be borne in mind that fish in the Mediterranean is mainly commercialised fresh and prices are relatively high [3], and modifications in market supplies will affect prices. Thus it is important to consider not only the fishing time reduction but also how to distribute it throughout the year to ensure that it does not affect market supplies

and to prevent the closure of traditional commercial circuits. Reductions have to be implemented in a transparent and equitable manner, without endangering the fisheries. Changes in trade could cause collateral effects with potential to generate serious economic losses to fishermen and alter fish supplies for consumers that the bio-economic models cannot simulate. For example, concentrating the reduction in a season may cause a price decrease [17] due to the irregular supply of fresh fish to the market and a reduction of market share.

On the other hand, if the reduction is distributed weekly, market supply is guaranteed all year round and prices may increase, thus reducing the short term social and economic impact [18]. In addition, a weekly reduction will not require subsidies, unlike many current seasonal closures in the Mediterranean [18]. As of today, fishers in some Spanish regions like Castellon are voluntarily reducing fishing time in one day per week during winter months without subsidies.

If provisions are made to transfer allowable effort between boats, the social impact will be even larger. Mediterranean fishing companies are usually small family enterprises, but this may change with the introduction of transferability of fishing days. The transfer of fishing possibilities between boats may concentrate fishing rights in larger companies reducing the fleet and changing the economic structure of Mediterranean fisheries with a severe impact on employment. There is a risk that fishing could disappear in some Mediterranean towns, which would lose an important part of their historical heritage. Concentration of fishing rights and loss of access to the fishery for some towns are among the side effects of the Icelandic ITQ system, followed by increased unemployment, decrease of property values as population size declines and the range of services available narrows [19,20]. Most fishers are worried about the possibility that individual effort quotas are introduced and they are demanding a global management of fishing days.

Other possible technical measures that could complement the fishing time reduction are the implementation of permanent and seasonal closures, selectivity improvements and local co-management plans.

The multi-annual plan for demersal fisheries in the western Mediterranean introduces a seasonal bottom trawling ban within 6 nautical miles from the coast except in areas deeper than 100 m during 3 months each year. A similar regulation was implemented in Spain between 1975 and 1988 but, to our knowledge, its effectivity has never been evaluated. It may be substituted other closure areas leading to a 20% mortality reduction on hake juveniles.

On the other hand, permanent closures may be useful to protect also sensitive habitats and spawning grounds. The benefits of closures for stock enhancement and biodiversity conservation are known [21] but the current extension of areas closed to fisheries is too small [22]. Moreover, in most countries, areas are closed to protect some particular

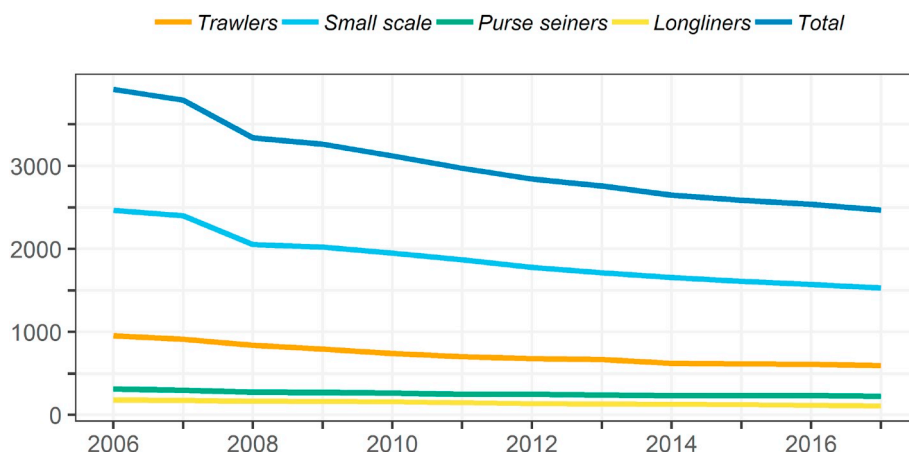


Fig. 1. Evolution of Spanish fleet in the Mediterranean.

Source: Data from “Censo de Flota Pesquera Operativa” (fishing fleet census) issued on December 31st annually.

habitat, i.e. shallow water reefs but, to be effective, protection measures must expand to include a significant proportion of all different marine habitats [22].

Improvement of trawl selectivity would have noticeable and complex direct and indirect effects on target and non-target demersal species [23] and would reduce the mortality on target species juveniles [24]. Increasing the size at which commercial species are captured will result in a higher economic yield for the fleets and larger biomass at sea of the exploited stocks, but most importantly it will contribute as well to restore ecosystem structure and resilience [15]. Moreover, the current reference points in the Mediterranean demersal fisheries are based on $F_{0.1}$. As consequence, changes in the selection pattern will change the reference points [25] reducing the distance between current and target fishing mortality. Scott and Sampson [26] show that relatively subtle changes in selection can produce substantial differences in MSY and F_{MSY} . Hence, drastic reductions in fishing effort may be unnecessary to achieve F_{MSY} if Mediterranean fisheries are oriented towards more selective fishing practices [27].

The EU fisheries policy recognizes the need to involve resource users in management and consequently shift towards co-management. A good way to involve stakeholders would probably be the adoption of local management strategies. Prior studies have shown positive achievements in the implementation of co-management plans at local level in certain fisheries [28–31]. The first experience of co-management in trawl fisheries was the experimental plan for trawl fisheries in Castellón and southern Tarragona that was implemented between 1961 and 1966. This plan was based in effort management and it recovered the profitability of trawl fleet in the region see Ref. [32]. It also demonstrates the importance of reaching a consensus in the management rules between scientist and fishers and the effectiveness of the bottom up approach for management. Enhancement of local co-management in the future may be a positive course of action.

The proposal also states that management measures based on total allowable catch shall be introduced if changes in the fishing effort regime do not suffice to meet the objectives or targets. However, it is likely that if the fishing effort regime does not produce the expected results it will be due to an insufficient reduction of fishing effort. A combination of the reduction of fishing time, the establishment of well-designed closed areas and an improvement of selectivity should lead to a significant improvement of Mediterranean fisheries. On the other hand, the introduction of output controls with Total Allowable Catches (TACs) and quotas for Mediterranean demersal fisheries will create new administrative and management problems, i.e. increase of illegal fishing and discards (see Ref. [33] and references therein), worsened by the high catch diversity characteristic of the Mediterranean [9,34].

3. Challenges for the future

Mediterranean fishery science has been generally less well funded and sophisticated than in the Atlantic region, which has long benefited from the support of the International Council for the Exploration of the Sea (ICES), which has a much stronger capacity for monitoring and conducting quantitative fishery assessments [35]. Probably this is related to the fact that Atlantic fisheries are targeted by international fleets in the high seas whereas Mediterranean fisheries are mostly coastal, targeted by local fleets and under jurisdiction of single states. Stock assessment information has not been incorporated to Mediterranean fisheries management yet. To advance in this direction it is necessary to improve the quality and quantity of scientific information available to have a better advice based in better science. Unfortunately, the Mediterranean stocks regularly assessed are still a small fraction, although this varies greatly among the different coastal states. GFCM experts stressed recently the need to advance the methodologies used for assessments and to improve the quality of data [5].

To this purpose, training opportunities for new experts that may recruit into GFCM, STECF and national research institutes are also

needed to increase capacity building in the region.

Also, current delimitation of stock boundaries for many of the stocks assessed it is not clear in the Mediterranean. Stock assessment is based mainly on Geographical Subareas (GSAs) that may not be adequate for some stocks. Some preliminary results have been obtained in the STOCKMED and TRANSBORAN research projects and other similar projects, but they need to be checked with further research. Identification of fished stocks that includes as well information on nursery and spawning areas helps to optimize management [36]. There is no scientific evidence that Effort Management Units established in the Western Mediterranean Multiannual Plan are the best management option. The importance of delimitation of stocks in the Alboran Sea was already highlighted by GFCM and probably stocks GSA 1 are more related with stocks GSAs 3 and 4, that are not included in the Western Mediterranean Multiannual Plan, than with GSA 5–7 that are in the same Effort Management Unit.

Finally, most stocks are evaluated with monospecific models due to the great data requirements and complexity of ecosystem models. Models developed for mono-specific fisheries are not appropriate for the evaluation and management of highly diverse Mediterranean fisheries because it is not possible to simultaneously achieve maximum sustainable yield in mixed fisheries. It can be argued that decreasing F towards a F_{MSY} goal in the context of multispecies fisheries will undoubtedly have a positive impact in accompanying species. However, F_{MSY} depends on fishing mortality at age, gear selectivity, annual variability and other factors that can change too fast for management to respond timely [37]. Thus, reaching MSY for all exploited stocks is not feasible [38]. Besides, it creates inconsistencies between targets for different stocks [25,39,40] and the target of F_{MSY} for the most vulnerable stock probably is not the best option. With this perspective, it would be advisable to find new scientific indicators that could contribute to define optimal harvest of Mediterranean demersal resources that consider its multi-specific nature [41].

According to the 2017 MaltaMedFish4Ever Ministerial Declaration on the future of Mediterranean fisheries, all relevant stocks have to be managed with multiannual plans by 2020. This means that new management plans have to be prepared for the Mediterranean, including the small pelagic species since they represent a significant proportion of landings in the region.

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Appendix A. Supplementary data

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